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Are Changes in Acquisition Policy and Process and in Funding Climate Associated With Cost Growth?

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14. ABSTRACT

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Are Changes in Acquisition Policy and Process and in Funding Climate Associated With Cost Growth?

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Abstract

This paper reports the results of research on whether changes in Department of Defense (DoD) acquisition policy and process have had a discernible effect on the growth of Program Acquisition Unit Cost (PAUC) of major defense acquisition programs (MDAPs). Examination of PAUC growth data for 151 MDAPs that passed Milestone II or B during fiscal year (FY) 1970–FY 2007 does not reveal any substantial or consistent effect of changes in acquisition policy and process. Changes in funding climate, however, are found to have a large influence on PAUC growth. These findings have three implications for acquisition reform. First, the relevant context for understanding PAUC growth is the interface between the acquisition process and the program/funding process. Second, it seems unlikely that further changes in the acquisition process will have a major effect on PAUC growth. Third, the underlying cause of persistent high PAUC growth is not, as is commonly asserted, a deeply established culture of the DoD acquisition organizations and their professional employees.

Introduction

This paper reports the results of research on whether changes in Department of Defense (DoD) acquisition policy and process have had a discernible effect on the growth of Program Acquisition Unit Cost (PAUC) of major defense acquisition programs (MDAPs).[1] A few previous studies have broached this topic, but it has received little attention, and the work that has been done has not resulted in any accepted or even widely recognized conclusions.[2]

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[1] The text of this paper is substantially identical to that of David L. McNicol and Linda Wu (2014), *Evidence on the Effect of DoD Acquisition Policy and Process on Cost Growth of Major Defense Acquisition Programs.* The appendices of P-5126 and its associated data CD are not included here, however. A PDF version of the paper is available at https://www.ida.org/~/media/Corporate/Files/Publications/IDA_Documents/CARD/P-5126.ashx. To obtain a hard copy, contact IDA Library Reference Services at (703) 845-2087 or refdesk@ida.org. A summary of P-5126 is included in *Defense Acquisition Reform: Where Do We Go From Here?* (2014).

[2] The literature includes many analyses of particular acquisition policies. There also have been several largely qualitative studies of, for example, the extent to which a set of related initiatives has been successful or, to offer another example, the apparent successes and shortcomings of the acquisition process over a specific time period, such as a decade. In contrast, there have been few broad quantitative assessments of the effectiveness of acquisition policy and process. The main predecessors of this work, in particular, are David L. McNicol (2005), *Cost Growth in Major Weapon Procurement Programs*, 2nd ed., especially pages 41–44 and 55–59, and Tyson et al. (1992), in *The*

The establishment of the Defense Systems Acquisition Review Council (DSARC) in late fiscal year (FY) 1969 marks the start of systematic Office of the Secretary of Defense (OSD) oversight of MDAPs. While an initiative of then Deputy Secretary of Defense David Packard, the DSARC responded to intense congressional concerns with growth in the costs of major DoD weapon system acquisition programs. It appears to have generally been regarded at the time as a successful innovation.

There have been many changes, large and small, in DoD acquisition policy and process since the DSARC was established. Many of these were undertaken simply for reasons of good government—to reduce the costs of the decision-making process and the time it requires, to increase its transparency, to make it more responsive to policy direction, and to adapt it to changes in the technological and national security environment. Many others were aimed directly at improving outcomes on MDAPs—in particular, reducing cost growth. This study was undertaken in the hope that a better understanding of the effects of these changes in acquisition policy and process on PAUC growth will contribute to the long-running discussion of reform of the DoD acquisition process.

Finding or making estimates of PAUC growth for a sufficiently large set of MDAPs was the first major challenge faced by this study. We have a PAUC growth estimate for 151 of the 309 distinct MDAPs that filed at least one SAR during FY 1969– FY 2007, a bit less than half of the total. The programs for which we have a PAUC growth estimate do not include any of the approximately 75 MDAPs that were terminated with little or no production. It would be interesting to have a reasonable PAUC growth estimate relative to the Milestone (MS) II/B[3] baseline for these programs, but developing such estimates would require far more resources than were available for this study. The study, then, does not provide a comprehensive picture of cost growth; doing so was not its intent. The question asked is whether changes in acquisition policy and process over time have visibly had an influence on PAUC growth. We ask that question for MDAPs that passed MS II/B as Acquisition Category (ACAT) I programs and progressed into full rate production. The question is not explored for programs that were cancelled or truncated.

Appendix A of McNicol and Wu (2014) describes the sources of the PAUC growth estimates used and puts the MDAPs for which a PAUC growth estimate was available in the context of the entire population of MDAPs. The paper also provides the data we used on a compact disc (CD). Unless stated otherwise, *PAUC growth* here means PAUC growth normalized to the MS II/B baseline quantity.

Effects of Management Initiatives on the Costs and Schedules of Defense Acquisition Programs, Vol. I: Main Report. More recently, Obaid Younossi et al. (2007), in *Is Weapon System Cost Growth Increasing? A Quantitative Assessment of Completed and Ongoing Programs*, concluded from their careful study of trends in development cost growth that "despite the many acquisition reform and other DoD management initiatives over the years, the development cost growth of military systems has not been reduced." (Summary page xx). References to the previous literature are provided in both McNicol and Younossi.

[3] DoDI 5000.2 issued Oct. 23, 2000, formally established Milestones A, B, and C (in place of Milestones I, II, and III) as the main decision points for an MDAP. Milestones A, B, and C began to be used somewhat earlier for new programs, however.

The second major challenge was one of research design. In broad outline, the paper identifies natural experiments that may shed some light on the effects of acquisition policy on PAUC growth and then interprets the outcomes of those experiments. In part, this is straightforward. We know when the main changes in acquisition policy and process occurred and what they were. The overall DoD acquisition funding climate in various periods—the second main element of the natural experiment—also can be readily established. The problem is that, in addition to the easily identified elements of the natural experimental design, there are a considerable number of other factors that had some influence on PAUC growth. We first limit attention to acquisition regime and funding climate and then, as particular results are stated, ask whether they are compromised by the omission of other factors.

Building Blocks

Discussions of acquisition reform over the past 25 years have usually put DoD program manager (PM) and personnel in the program office in the foreground. These people oversee the contractors and do a myriad of things that must be done by the government for a major acquisition program to move forward—contracting, financial management, and test planning, among many others. In the background are the contractors who typically do the development and manufacturing. A good program will not occur if the government personnel and contractors do not do their jobs well. It is equally true that if these individuals and organizations do their jobs well, a good outcome for the program is more likely.

What this focus on the DoD PM, the program office personnel, and the contractors' PMs and workers leaves out are factors they must accept as "givens." These givens are subject to changes—sometimes large and fairly sudden—that presumably have substantial consequences for program outcomes. One of the givens is the topline DoD funding constraint, which does not determine, but generally has a marked influence on, the funding for individual MDAPs. A second is DoD acquisition policy and process. We begin with the latter.

Acquisition Regimes

This paper distinguishes five successive DoD acquisition regimes:[4]

1. The Defense Systems Acquisition Review Council (DSARC), 1970–1982
2. The Post-Carlucci Initiatives DSARC, 1983–1989[5]
3. The Defense Acquisition Board (DAB), 1990–1993
4. Acquisition Reform (AR), 1994–2000

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[4] The main reference we have used is J. Ronald Fox (2011), Defense *Acquisition Reform, 1960 to 2009: An Elusive Goal*. Fox identifies the main features of each of these periods as well as the most important changes that took place within them.

[5] After then Deputy Secretary of Defense Frank Carlucci. There is some uncertainty about when the Post-Carlucci Reforms DSARC should end and the DAB regime should begin. The relevant statutes were passed in 1986, and the DAB began functioning under that name in late FY 1987 or early FY 1988; however, the DoD did not implement the full set of reforms required by statute until 1990. We have for that reason set the line at 1990.

5. The DAB–Post Acquisition Reform, 2001–2007 (because our PAUC growth data ends in 2007)

The transition from the first phase of the DSARC (1970–1982) to the second was principally a matter of policy direction and renewal. The 34 Carlucci Initiatives (regime number 2) were intended to increase the efficiency and effectiveness of the OSD acquisition oversight process and the Planning, Programming, and Budgeting System (PPBS). While the DAB (number 3) itself bears a strong family resemblance to the DSARC, the statute creating it directed management changes intended to strengthen what is now the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]). This statute also created the position of Vice Chairman of the Joint Chiefs of Staff (VCJCS) and directed a new requirements process centered on the VCJCS. The results sought by AR (number 4) were improvements in MDAP outcomes, but changes made during that period (not all part of AR) somewhat relaxed OSD oversight of MDAPs. There were, in particular, substantial cuts in acquisition staffs at both the OSD level and Service Headquarters level, and senior decision-makers took a more permissive attitude towards cost growth. The Post-AR regime (number 5) was marked by the arrival of a new administration in January 2001, which brought policy changes but no major changes to the acquisition process or statutes.

Table 1 displays the average PAUC growth for MDAPs that passed MS II/B or filed a first SAR in each of these successive regimes. There are a number of interesting aspects to these data, for example, the high PAUC growth during the AR period and the lower PAUC growth for FY 2001–FY 2007. Granting that, the single most notable feature of these data is the absence of any trend in PAUC growth. If changes in acquisition policy and process have had a sustained influence on PAUC growth, it does not show up in this table.

Table 1. Average PAUC Growth in Successive Acquisition Regimes

Acquisition Regime	Time Period	Average PAUC Growth	No. of Observations
DSARC	1970–1982	32%	48
Post-Carlucci Initiatives DSARC	1983–1989	19%	40
DAB	1990–1993	36%	11
Acquisition Reform (AR)	1994–2000	66%	27
DAB post AR	2001–2007	19%	25

In constructing Table 1, we assigned the PAUC growth of each program to the acquisition regime in place when the program passed MS II/B or filed its first SAR. At first glance this may seem dubious, since a program can easily take 10 or 15 years from the start of Engineering and Manufacturing Development (EMD) through delivery of the final production lot and thus spend parts of its acquisition cycle under successive acquisition regimes. Note, however, that our estimates are of PAUC growth measured from the baseline established at MS II/B, which does not change over the course of a program's acquisition cycle. It remains possible that the actual acquisition costs of a program are significantly influenced by policy or process changes made after its MS II/B. Evidence presented in Appendix B of McNicol and Wu (2014) suggests that if such influences exist, they are much smaller than the effect of the cost estimate in the MS II/B baseline.

Broadly, there are two ways to explain the absence of sustained effects of acquisition policy and process on the PAUC growth data. First, they may in fact not have a strong or consistent effect on PAUC growth. Second, acquisition policy and process may have substantial effects that are masked by some other factor or factors.

Funding Climate

Thinking along the lines of the second of these possibilities led to consideration of whether changes in the DoD acquisition funding climate might be associated with PAUC growth. We have a PAUC growth estimate for 151 MDAPs that passed MS II/B or submitted a first SAR during FY 1969–FY 2007. This period includes two sub-periods during which acquisition funding was Relatively Constrained: FY 1970–FY 1980 and FY 1987–FY 2002. We also have two sub-periods in which the acquisition funding climate was Relatively Accommodating: FY 1981–FY 1986 and FY 2003–FY 2007. (We did not include any program not at least five years beyond MS II/B, and the 2012 SARs were the last available for this study.)[6]

Table 2 displays the average PAUC growth data for these four sub-periods. The average PAUC growth in periods of Relatively Constrained acquisition funding is far larger than it is in periods of a Relatively Accommodating funding climate—by a factor of three in the first comparison and by a factor of seven in the second.

Table 2. Average PAUC Growth During Different Acquisition Funding Climates

DoD Topline Relatively Constrained		DoD Funding Relatively Accommodating	
Period (FY)	PAUC Growth	Period (FY)	PAUC Growth
1970–1980	35% (42)	1981–1986	12% (35)
1987–2002	53% (55)	2003–2007	7% (19)

Note. Numbers in parentheses are the number of observations available.

What the data in Table 2 portray goes well beyond "budget instability" as usually understood. Budget instability is a term of art for changes in MDAP funding through the annual resourcing cycle and "taxes." Budget instability is a chronic condition, present to some degree in all periods. What this paper observed is a recurring pattern—that MDAPs that passed MS II/B during periods when the acquisition funding was Relatively Constrained, on average, had much higher PAUC growth than those that passed MS II/B during periods of a Relatively Accommodating funding climate.

Statistical Results

Table 3 expands Table 2 by replacing the funding climate sub-periods with the acquisition policy and process regimes. This table provides results for two sets of natural experiments. First, the PAUC growth columns give the effect of changes in the acquisition regime for a given funding climate. Second, the rows show the effect of funding climate for a given acquisition regime. For example, the first 11 years of the DSARC (FY 1970–FY 1980)

[6] We use as the breakpoints that define these periods events that marked major changes in expectations about the course of defense spending: (1) the invasion of Afghanistan by the Soviet Union in December 1979 (FY 1980), which about a month later led President Carter to announce a policy of sustained increases in defense spending starting with the FY 1981 funding; (2) the adoption in December 1985 (end of the first quarter of FY 1986) of the Gramm-Rudman-Hollings Act, the funding constraints of which effectively ended the Carter–Reagan defense buildup; and (3) the 9/11/2001 attacks. It is important to recognize that key decisions made within the DoD on content, costing, and funding for particular MDAPs in a given year are made at least a year in advance of the submission of the funding for that year to the Congress. Consequently, the DoD decisions in funding submissions reflect expectations about the climate that submission will encounter.

were in a tight funding climate, while the next two (FY 1981–FY 1982) were in a period in which the acquisition funding climate was Relatively Accommodating.

The two sections that follow discuss, in turn, whether changes in acquisition policy and process have visible effects on PAUC growth, and the association between funding climates and PAUC growth.

Table 3. Average PAUC Growth by Acquisition Regime and Funding Climate

	Relatively Constrained		Relatively Accommodating	
Acquisition Regime	**Period (FY)**	**PAUC Growth**	**Period (FY)**	**PAUC Growth**
DSARC	1970–1980	35% (42)	1981–1982	11% (6)
Post-Carlucci DSARC	1987–1989	34% (11)	1983–1986	13% (29)
DAB	1990–1993	36% (11)	None	N/A
Acquisition Reform (AR)	1994–2000	66% (27)	None	N/A
DAB post AR	2001-2002	57% (6)	2003–2007	7% (19)

Note. Numbers in parentheses are the number of observations available.

Any Trend in PAUC Growth?

There is no doubt that direction from the Milestone Decision Authority (MDA) changes particular MDAPs, and some of those changes reduce the risks of major PAUC growth or other program performance shortfalls. Viewed from this perspective, the question asked here is whether the decisions made (or not made) in different acquisition regimes are large enough and frequent enough to be visible in average PAUC growth.

Looking first at the Relatively Accommodating climate (column on the right in Table 3) and recognizing that it is likely that the average PAUC growth for FY 2003–FY 2007 eventually will be a few percentage points higher,[7] we can see no trend towards reduction in average PAUC growth in periods with a Relatively Accommodating funding climate. Statistical analysis is consistent with this impression; that is, we found no evidence of statistically significant differences among average PAUC growth rates for the Relatively Accommodating funding climate.[8]

[7] We have a PAUC growth estimate for 19 of the 25 MDAPs that passed MS B as ACAT I programs during 2003–2007 and which have not been cancelled or truncated. Of these 19 programs, six have been completed, six are in full rate production (FRP), three are in Low Rate Initial Production (LRIP), and four are in EMD. Younossi et al. (2007), in *Is Weapon System Cost Growth Increasing?*, found that on average, 60% of development cost growth occurs by five years after MS B. (31). Estimates of procurement cost growth also usually are increased as necessary to reflect EMD experience. Since each of the 19 programs is at least five years beyond MS B, even a doubling of the 7% average PAUC growth would be unexpected.

[8] The method used was one-way analysis of variance (ANOVA). ANOVA is a test of whether three or more samples are drawn from populations with the same mean. The null hypothesis is that all population means are equal; the alternative hypothesis is that at least one mean is different. In this case, the alternative hypothesis was rejected at the 1% level. ANOVA assumes that (1) the populations from which the samples were drawn are normally distributed, (2) the samples are independent, and (3) the variances of the populations are equal. We are grateful to Dr. Sarah Burns for her advice on the statistical analysis and for doing the computations.

The average PAUC growth rates for the two most recent acquisition regimes during a Relatively Constrained funding (column on the left in Table 3) are noticeably larger than those for the three earlier periods. Again, however, the statistical analysis did not indicate that any of the averages is statistically different from the others at the 1% confidence level.

Appendix C of McNicol and Wu (2014) presents a table similar to Table 3 for each of the Military Departments and for joint programs. None shows an improving trend in PAUC growth in either of the two funding climates, and with a small number of exceptions, these tables show the same features we see in Table 3.

We have no fully comparable PAUC growth data for the periods before the DSARC was established. Consequently, the statistical analysis leaves open the possibility that the DSARC and its successors provided a useful discipline on acquisition programs.[9] Moreover, the statistical analysis does not erase history. Weapon system cost growth was a particular concern during the 1980s—the sixth Carlucci Initiative was "Funding to Most Likely Costs"—and it is reasonable to believe that the Carlucci Initiatives did in fact lead to more vigorous enforcement of realistic funding. We also know that less emphasis was placed on weapon system cost growth during the AR years, and oversight of acquisition programs was somewhat more relaxed. It could be that these differences do provide part of the explanation for the higher observed average PAUC growth during the AR years. The statistical analysis prevents us from asserting with confidence that they do, however, because those differences are within the bounds of what can be expected from the variability of the data.[10]

It remains possible that factors that have not been considered in this paper mask significant influences of acquisition policy and process on PAUC growth that a more refined analysis would reveal.[11] In considering this possibility, it must be kept in mind that the issue is *growth* in PAUC from the MS II/B baseline, not the trend over time in costs for a commodity group or the acquisition portfolio as a whole. Such trends, which may well exist, do not necessarily imply more cost growth for individual programs, as they should be

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[9] The most nearly comparable data seem to be those in Table A-7 (pp. A-6 to A-8) of Appendix A of Tyson et al. (1992), *The Effects of Management Initiatives, Vol. I: Main Report.* These data are quantity adjusted, but for some programs cost growth may not be measured from the estimates at the start of EMD, and the sample may include programs that were cancelled. Omitting one program with an extremely high cost growth (Condor), the average PAUC growth for the pre-1970 MDAPs was 48%, which is noticeably higher than the average PAUC growths during 1970–1978.

[10] For example, the exceptionally high average PAUC growth during the AR years (66%) can be attributed in part to changes in the program mix. During the AR years, four helicopter programs passed MS II/B, one more than average for a period of this length. Moving the helicopter program with the highest PAUC growth (H-1 Upgrades) from 1994–2000 to 1987–1989 reduces the average PAUC growth for the AR years from 66% to 61%, and increases the average for 1987–1989 from 34% to 48%.

[11] Results of McNicol (2004) point to one possibility—changes in programs that occur after they pass MS II/B. This work considered growth in quantity normalized unit procurement costs after excluding costs of unforced changes in program content (i.e., changes not required to overcome some problem "baked into" the program in the MS II/B baseline). McNicol found evidence that some changes in the acquisition process had had a statistically significant effect on this measure of cost growth. See, in particular, pp. 43–44 and 55–56.

reflected in the MS II/B baselines. Further comments on possible confounding variables are made below. The conclusion offered here is that once we normalize for funding climate, we do not observe any improvement in PAUC growth from the changes made over the years in acquisition policy and process.

Association of Funding Climate and PAUC Growth

Returning to Table 3, the relevant comparisons are between the Relatively Constrained and Relatively Accommodating funding climates for a given acquisition regime. Whereas the effects on PAUC growth of the different acquisition regimes are elusive, those of the contrasting funding periods stand out sharply.

We have only three experiments of changes in funding climate for a given acquisition regime, since two of the five acquisition regimes (DAB and AR) fall entirely within one funding climate—Relatively Constrained. Each of these three natural experiments on the effect of funding climate has the same outcome—passing MS II/B during a Relatively Constrained funding climate is on average associated with much higher PAUC growth compared to passing during a Relatively Accommodating funding climate for a given acquisition regime. The outcomes of the first two experiments are virtually identical—an average PAUC growth of 35% and 34%, respectively, in the two periods when the topline was Relatively Constrained and average PAUC growth of 11% and 13%, respectively, in the two periods when the topline was Relatively Accommodating. The effect seems most pronounced in the third experiment (DAB post-AR)—57% for FY 2001–FY 2002 and 7% for FY 2003–FY 2007. (As noted earlier, PAUC growth for the later period will increase somewhat as the programs of that period are completed; see footnote 8.) The statistical analysis found each of these differences to be significant at more than the 1% level.[12]

There is a distinct pattern to the changes in funding climate over our sample period—bust, boom, bust, boom. If some other factor or combination of factors is actually at work, rather than funding climate, it would have to have this same pattern. One possibility is that the methods used to estimate PAUC growth for MDAPs that passed MS II during FY 1989–FY 2007 are not the same as the method used for those that passed MS II during FY 1970–FY 1988. Appendix A of McNicol and Wu (2014) provides a comparison that suggests that differences in estimating methods do not explain the low average PAUC growth recorded for FY 2003–FY 2007 or the comparatively high cost growth observed for FY 1990–FY 2002. The obvious interpretation of Table 3, and the one we believe to be correct, is that it really is changes in funding climate at work.

This does not mean that a Relatively Constrained funding climate causes PAUC growth. The proximate causes of PAUC growth are decisions embedded in programs approved at MS II/B (unrealistic cost estimates or programmatic assumptions, for example) and decisions made during program execution (such as failing to act promptly enough on test results) that eventually lead to PAUC growth. The correlation observed between higher PAUC growth and periods of tighter funding climate does suggest that programs are more likely to be burdened with such decisions if they passed MS II/B during a Relatively Constrained funding climate.

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[12] In this case, we used the usual one-tail test for the difference between the means of samples drawn from what are assumed to be normal populations.

Is High PAUC Growth Systemic in the Relatively Constrained Funding Climate?

Based on the analysis thus far, it would not be surprising to find that almost all programs that pass MS II/B during a period with a Relatively Constrained funding climate are burdened with the sorts of very optimistic programmatic and costing assumptions that tend to result in high PAUC growth. Alternatively, the bulk of the cost growth might be accounted for by a relatively small number of MDAPs. Which of these two cases is the more nearly accurate is relevant to the discussion of acquisition reform. In the first case, it is reasonable to assume that PAUC growth is a systemic problem. It is often said, for example, that the acquisition culture has a bias in favor of optimistic programmatic and cost assumptions. PAUC growth looks much less like a systemic problem with the acquisition process, however, if most of it is due to a small number of MDAPs.

The first column of Table 4 shows the average PAUC growth (in periods of Relatively Constrained funding climate) of MDAPs that had a PAUC growth between zero and 50%. The average for these MDAPs was a PAUC growth of about 22%. The second column shows the average PAUC growth of those MDAPs that experienced a PAUC growth of at least 50%. These range from a low of 71% (FY 1970–FY 1980) to a high of 122% (FY 1994–FY 2000). The average of these values is 94%. Finally, the last column in Table 4 shows the *percentage* of PAUC growth in these periods accounted for by MDAPs with PAUC growth of at least 50%. The range is 62% to 89% and, averaged across all five periods, the high cost growth MDAPs accounted for just over three-quarters of total PAUC growth. (The figures shown in Table 4 are computed from simple averages rather than weighted by program size.[13]) In short, PAUC growth is mainly an affliction of Relatively Constrained funding climates and it is primarily due to a minority of programs—on the order of 37%—that experience PAUC growth of upwards of 50%.

Table 4. Characteristics of PAUC Growth in Relatively Constrained Funding Climate

Acquisition Regime	Period (FY)	Average PAUC Growth of MDAPs with PAUC Growth between 0% and 50%	Average PAUC Growth of MDAPs with PAUC Growth ≥ 50%	% of PAUC Growth Accounted for by MDAPs with PAUC Growth ≥ 50%
DSARC	1970–1980	21% (22)	71% (15)	73%
Post-Carlucci DSARC	1987–1989	22% (7)	117% (2)	62%
DAB	1990–1993	21% (7)	84% (3)	64%
Acquisition Reform	1994–2000	22% (10)	122% (13)	89%
DAB post AR	2001–2002	29% (3)	85% (3)	75%

Note. Numbers in parentheses are the number of observations.

[13] Weighting by program size would be required in any consideration of the effect of PAUC growth on funding, because cost growth on a large program has a greater effect on funding requirements than cost growth of the same magnitude on a smaller program. This paper, however, is concerned with examining the extent to which PAUC growth is associated with particular combinations of acquisition regimes and funding climates and in such a context, each observation counts as much as any other.

Does the Resource Allocation Process Play a Major Role in PAUC Growth?

This section turns to a discussion of MDAPs that experienced very high cost growth (interpreted as a PAUC growth of at least 50%) and MDAPs that experienced negative cost growth. Investigation of this topic was initially prompted by the prospect that instances of high cost growth and perhaps also of negative cost growth mask effects of acquisition policy and process on PAUC growth. The topic proves to be interesting for other reasons as well. First, it provides clear and unexpected evidence of the connection between PAUC growth and funding climate and, by implication, the DoD resource allocation process. Second, cost growth proves not to be a problem with the typical system but with the minority of MDAPs that experience very high cost growth.

Negative PAUC Growth

Twenty-nine MDAPs in our sample show negative PAUC growth (not including four cases of zero PAUC growth). Viewed from an acquisition perspective, negative PAUC growth seems anomalous; in fact, it is not uncommon to hear confident assertions to the effect that MDAPs never underrun their funding. It is understandable, however, in a resource allocation context at the Service level.

Negative PAUC growth is recorded if the actual cost of a program proves to be less than the cost in the MS II/B baseline. Negative PAUC growth can occur because a program was particularly well managed or lucky. It also can occur if the ambitions of a program are scaled back after a program has passed MS II/B. In addition, negative PAUC growth can grow out of resource allocation imperatives.

Assuming the program was funded to its MS II/B baseline, negative PAUC growth implies that over time funds can be taken from the program in question and reallocated to other applications, including other acquisition programs. The program, then, effectively can be used as a "bank"—a way to hold reserves in relative safety until they are needed. A "withdrawal" can be made in the execution year with the approval of the Congress, but for the outyears of the Future Years Defense Plan (FYDP), the Service can simply initiate the reallocation in its Program/Funding submission to the OSD.

A bank of this sort is more likely to be needed in a Relatively Accommodating funding climate, as it can then serve as a way to delay final decisions on allocation of the higher level of funding that has become available. We would therefore expect to find relatively more instances of negative PAUC growth in the Relatively Accommodating funding periods, and this is what we observe. As the data in Table 5 indicate, about 30% of our observations in Relatively Accommodating funding climates are of negative PAUCs, compared to about 12% across the periods of Relatively Constrained climate.

Table 5. Number of PAUC Growth Observations Less Than Zero by Acquisition Regime and Funding Climate

	Topline Relatively Constrained		Topline Relatively Accommodating	
Acquisition Regime	Time Period (FY)	PAUC Growth < 0	Time Period (FY)	PAUC Growth < 0
DSARC	1970–1980	5 of 42	1981–1982	2 of 6
Post-Carlucci DSARC	1987–1989	2 of 11	1983–1986	10 of 29
DAB	1990–1993	1 of 11	None	N/A
Acquisition Reform (AR)	1994–2000	4 of 27	None	N/A
DAB post AR	2001–2002	0 of 6	2003–2007	5 of 19

Negative PAUC growth is not regarded as a problem, probably correctly. It is, however, a clear and unexpected case in which PAUC growth reflects accommodation to the funding climate.

PAUC Growth ≥ 50%

Adoption of unrealistically low cost estimates at MS II/B creates the illusion that the funds available over the FYDP and beyond will support more MDAPs than they in fact will. That is, unrealistically optimistic costing will for a time permit more new starts.[14] In addition, the conventional wisdom holds that a lower MS II/B cost makes it easier to gain the concurrence of the OSD, the Office of Management and Budget, and the Congress for a new program. Consequently, we would expect to find relatively more programs with PAUC growth of at least 50% in Relatively Constrained funding climates, which is in fact what we do find.

Table 6 reports the number of programs with an average PAUC growth of at least 50%. Of the 54 programs that passed MS II/B in a Relatively Accommodating funding climate, only four showed PAUC growth of at least 50%. In contrast, 36 of the 97 programs that passed MS II/B in a Relatively Constrained funding climate showed cost growth of at least 50%. This is to say that the frequency of MDAPs with a PAUC growth of at least 50% is much lower in periods when the topline is Relatively Accommodating than in a Relatively Constrained funding climate—7% versus 37%.

Table 6. Number of PAUC Growth Observations ≥ 50% by Acquisition Regime and Funding Climate

	Topline Relatively Constrained		Topline Relatively Accommodating	
Acquisition Regime	Time Period (FY)	PAUC Growth ≥ 50%	Time Period (FY)	PAUC Growth ≥ 50%
DSARC	1970–1980	15 of 42	1981–1982	0 of 6
Post-Carlucci DSARC	1987–1989	2 of 11	1983–1986	3 of 29
DAB	1990–1993	3 of 11	None	N/A
Acquisition Reform (AR)	1994–2000	13 of 27	None	N/A
DAB post AR	2001–2002	3 of 6	2003–2007	1 of 19

Reexamination of Trends in PAUC Growth

The circumstances in which we are more likely to see very high PAUC growth and instances of negative PAUC growth suggest that they reflect accommodations to different funding climates. In other words, instances of high PAUC and negative PAUC may not reflect the normal operation of the acquisition process. On this basis, Table 7 presents average PAUC growths computed excluding observations of greater than or equal to 50% and negative values.

The statistical analysis of the data in Table 7 produces the same conclusions as that of Table 3 in one important respect: there is no indication of statistically significant differences across acquisition regimes within a funding climate. The difference between the

[14] It is not clear that doing this ever makes financial sense because the “loans” created by unrealistically low cost estimates eventually must be made good one way or another at an implicit but steep interest rate.

averages in the two funding climates for the DAB post AR is, however, statistically significant at the 1% level, but the differences for the other two cases (DSARC and Post-Carlucci DSARC) are not statistically different at conventional levels of significance.

Table 7. Average PAUC Growth Excluding Observations ≥ 50% and Negative Observations by Acquisition Regime and Funding Climate

	Topline Relatively Constrained		Topline Relatively Accommodating	
Acquisition Regime	Time Period (FY)	% of PAUC Growth	Time Period (FY)	% of PAUC Growth
DSARC	1970–1980	21% (22)	1981–1982	22% (4)
Post-Carlucci DSARC	1987–1989	22% (7)	1983–1986	13% (16)
DAB	1990–1993	21% (7)	None	N/A
Acquisition Reform (AR)	1994–2000	22% (10)	None	N/A
DAB post AR	2001–2002	29% (3)	2003–2007	10% (13)

Note. Numbers in parentheses are the number of observations.

Implications for Discussions of Acquisition Reform

This paper points to three implications for a discussion of acquisition reform. First, the relevant context for understanding PAUC growth is the interface between the acquisition process and the resource allocation process. The crucial evidence behind this point is the strong association between funding climate and PAUC growth. Resource managers must think in terms of a portfolio of programs across mission areas and commodity types, and extending from efforts in the technology base through programs nearing the end of production. When a program is completed, it opens a resource "hole" that programs emerging from EMD can occupy. In turn, programs earlier in the acquisition cycle can move forward as well. When funding for acquisition turns down, these holes get smaller, or close entirely, or require cuts in funding for ongoing programs. The alternatives available in this circumstance are all undesirable—cancellations of programs, delays in new starts, stretches, and unrealistic costing. The evidence summarized here suggests that it is in this context that high PAUC growth arises.

Second, it seems unlikely that further changes in the acquisition process would have a major effect on PAUC growth. The research found no evidence that acquisition policy and process changes through the years have produced sustained and significantly lower or higher PAUC growth. This does not mean that the DAB process does not provide a useful discipline on acquisition programs; moreover, further changes in acquisition policy or process might be warranted for reasons of good government. The evidence does, at a minimum, suggest that the effects of changes in the acquisition process since its inauguration in the early 1970s have not had a dominant effect on PAUC growth.

Third, it is difficult to see that the cultures of the DoD acquisition organizations are a crucial obstacle to improved performance on cost growth. The key point to note is that high PAUC growth is not persistent, but rather episodic, and correlated with environmental factors outside of the control of the acquisition process. There is remarkably little PAUC growth in periods when the funding is Relatively Accommodating. It seems fair to ask if it makes sense to assert that an entrenched culture sometimes results in high cost growth and other times in low cost growth. Just how is it that the A team takes the field so quickly and quietly when the budgetary sun comes out? And why even in bad budgetary weather do more than half of MDAPs exhibit comparatively modest PAUC growth?

References

Defense Acquisition Reform: Where Do We Go From Here?: Staff report prepared by the Permanent Subcommittee on Investigations of the Senate Committee on Homeland Security and Governmental Affairs. Washington, DC: GPO, 2014.

Fox, J. R. (2011). *Defense acquisition reform, 1969 to 2009: An elusive goal.* Washington, DC: U.S. Army Center for Military History.

Lorell, M. A., & Graser, J. C. (2001). *An overview of acquisition reform cost savings* (MR-1329). Santa Monica, CA: RAND.

McNicol, D. L. (2004). *Cost growth in major weapon procurement programs* (2nd ed.). Alexandria, VA: Institute for Defense Analyses.

McNicol, D. L., & Wu, L. (2014). *Evidence on the effect of DoD acquisition policy and process on cost growth of major defense acquisition programs* (IDA Paper P 5126). Alexandria, VA: Institute for Defense Analyses.

Tyson, K. W., Nelson, J. R., Om, N. I., & Palmer, P. R. (1989). *Acquiring major systems: Cost and schedule and acquisition initiative effectiveness* (IDA Paper P-2201). Alexandria, VA: Institute for Defense Analyses.

Tyson, K. W., Om, N. I., Gogerty, D. C., & Nelson, J. R. (1992). *The effects of management initiatives on the costs and schedules of defense acquisition programs, Vol. I: Main report* (IDA Paper P-2722). Alexandria, VA: Institute for Defense Analyses.

Tyson, K. W., Om, N. I., Gogerty, D. C., Nelson, J. R., & Utech, D. M. (1992). *The effects of management initiatives on the costs and schedules of defense acquisition programs, Vol. II: Analysis of ground combat and ship programs* (IDA Paper P-2722). Alexandria, VA: Institute for Defense Analyses.

Younossi, O., Arena, M. V., Leonard, R. S., Roll, C. R., Jr., & Sollinger, J. M. (2007). *Is weapon system cost growth increasing? A quantitative assessment of completed and ongoing programs* (MG588). Santa Monica, CA: RAND.

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